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(54) A vibration device, especially for a smooth roller apparatus

(57) In a vibration device 1 that may be employed as an independent entity or in a smooth roller apparatus, two rotatable eccentric weights 12 and 15 are angularly adjustable relative to one another, the chosen position determining the extent of the vibration which the device will produce. One eccentric weight 12 is supported on a power driven shaft 2, 2a and the other eccentric weight 15 on a hollow shaft 13 which is arranged concentrically around the first shaft 2,2a. The first shaft 2,2a is coupled to the second hollow shaft 13 by steeply pitched thread means 22 so that the shaft 13 can be turned angularly relative to the shaft 2,2a, together with the corresponding eccentric weight 15, against the action of a frictional muff or the like 19. Advantageously, the second shaft 13 surrounds, and is supported by, the portion 2a of the first shaft 2. A modified form of the vibration device that is suitable for mounting internally of the drum or cylinder of a smooth roller apparatus is also described and illustrated.

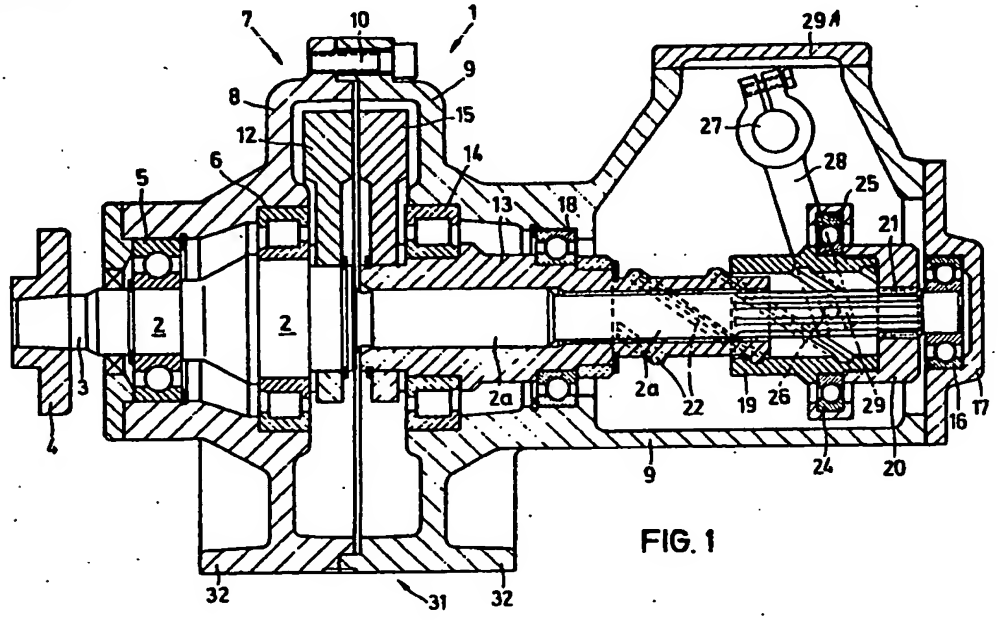

FIG. 1

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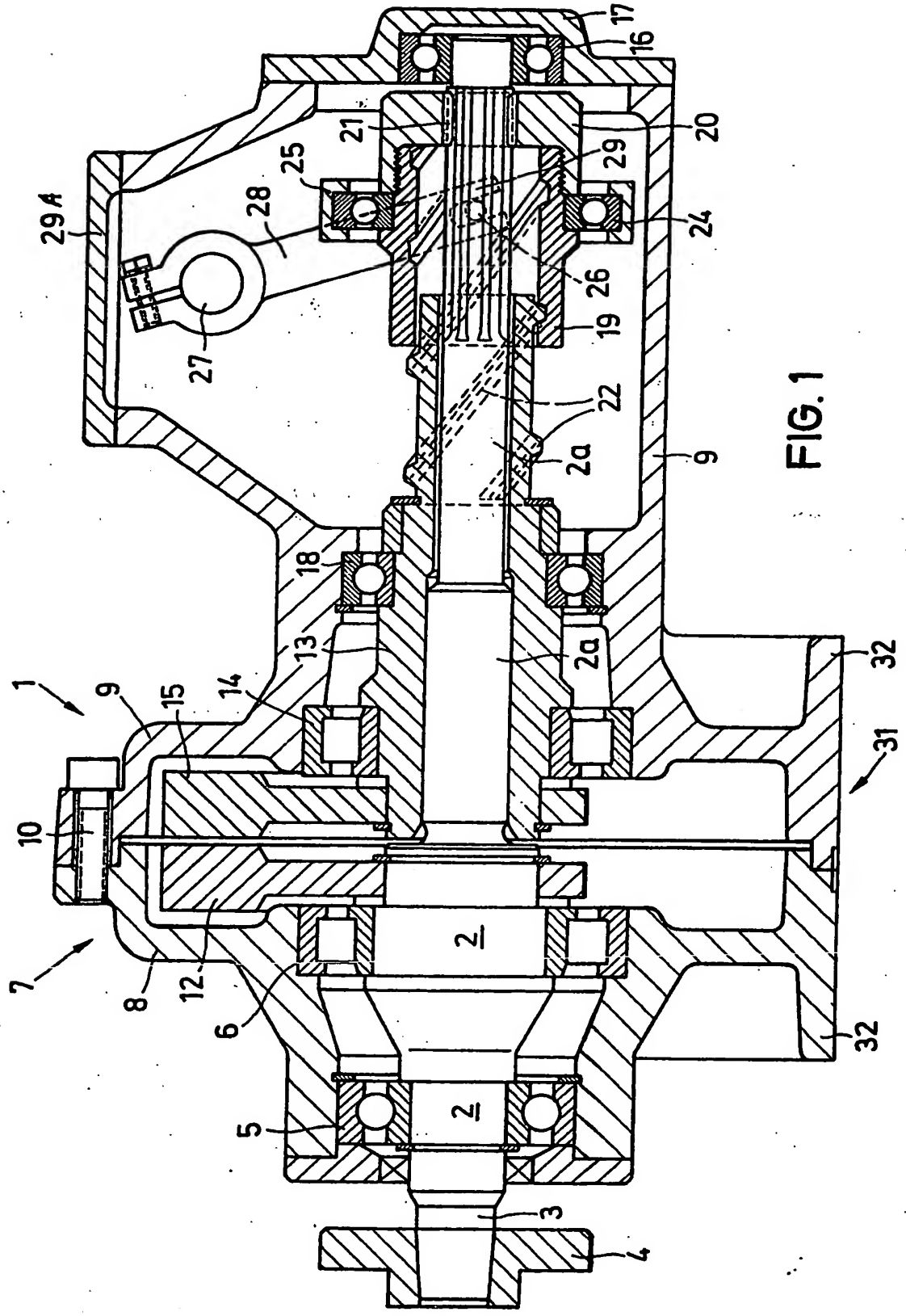
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7
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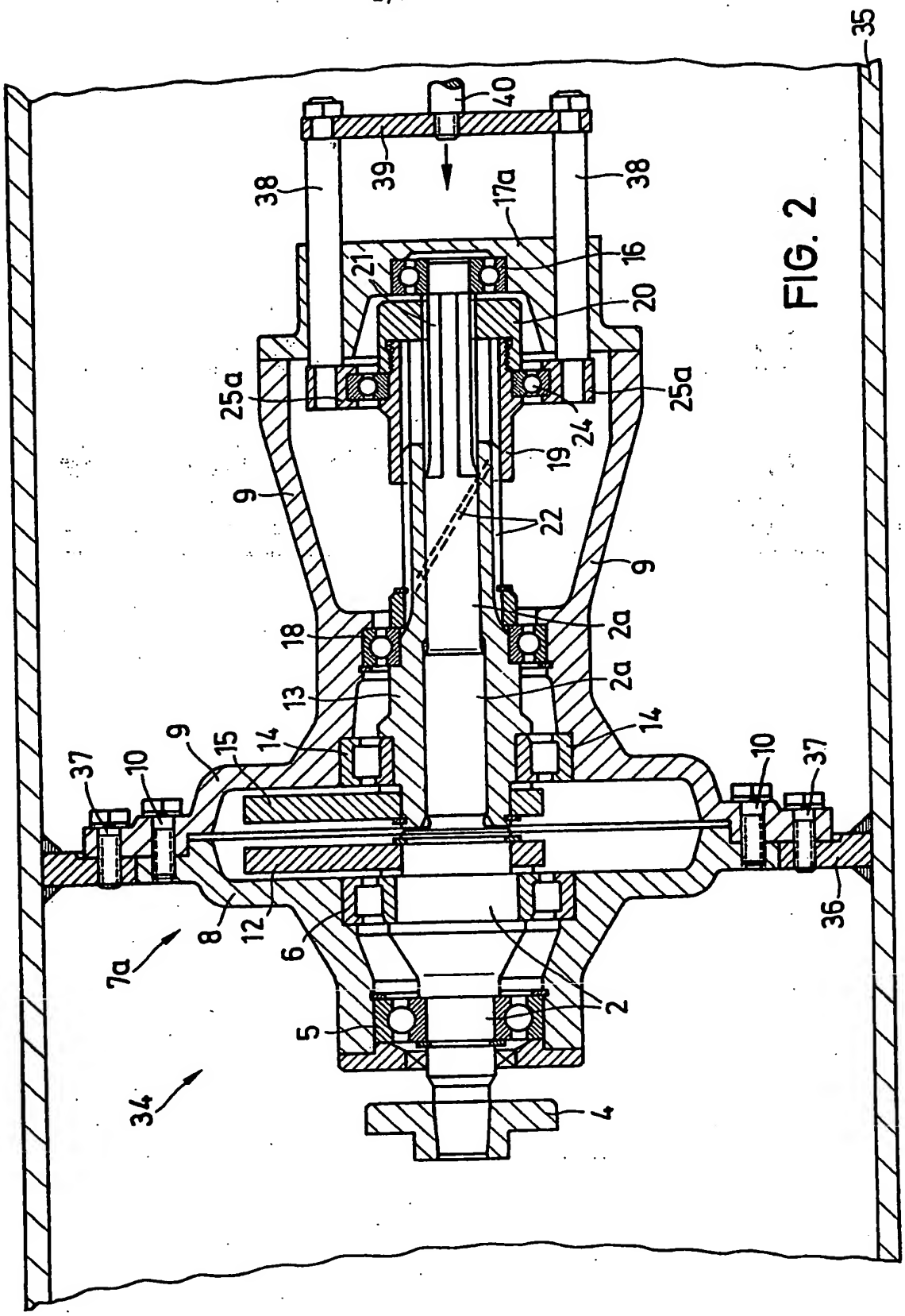
4

FIG. 1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7a
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34
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36

FIG. 2

SPECIFICATION

A vibration device, especially for a smooth roller apparatus

This invention relates to vibration devices, especially for smooth roller apparatus, which devices are of the kind comprising two drivably rotatable, eccentrically unbalanced weights that can be angularly adjusted relative to one another, by an adjusting mechanism, during operation of the device.

Varioius forms of such a vibration device are known. For example, the adjusting mechanism comprises bevel or planetary gearing that is operable angularly to adjust the two rotating and eccentrically unbalanced weights relative to one another in such a way that the vibration which is produced is infinitely variable between maximum and minimum values.

It is an object of the present invention to provide a vibration device of the kind set forth which is simple to construct and to use and that may be employed in conjunction with apparatus of numerous different kinds, in particular in conjunction with a smooth roller apparatus. Accordingly, there is provided a vibration device of the kind set forth, wherein one eccentric weight is supported on a power-drivable first shaft and the other eccentric weight on a second relatively co-axial shaft, the first and second shafts being connected by means which resists their relative angular displacement and the first shaft also being angularly displaceably coupled to the second shaft by steeply pitched thread means.

A vibration device in accordance with the invention is finely adjustable as regards the extent of the vibration which it will produce whilst being relatively short in axial length and thus of a compact construction. The relative angular adjustability of the two eccentric weights can be achieved in a simple manner and the complete compact device can easily and inexpensively be secured to any item that may require to be vibrated, whether that item is of a basically stationary formation or of a basically rotatable formation, such as a smooth roller apparatus.

The second shaft is advantageously of hollow formation and is rotatably supported on the first shaft, the means which resists their relative angular displacement advantageously being in the form of a muff of the like that is supported so as to be axially displaceable lengthwise of the first and second shafts. The interaction of the muff and the second shaft is facilitated by the steeply pitched thread means, the latter conveniently being arranged so that the eccentric weight which is carried by the hollow second shaft can be displaced around the longitudinal axis of that shaft to any required position within a 180° range. An adjustment can be carried out whilst the device is in use, with both of its eccentric weights rotating, by longitudinally displacing the muff. The device is so arranged that,when the two eccentric weights are at diametrically opposite sides of the axis of rotation, their effects will cancel one another out and there will be no significant vibration. When the two eccentric weights occupy substantially the same angular position around the axis of rotation, the vibratory effect will be at a maximum and this effect can be very finely adjusted byangularly displacing one weight relative to the other about said axis to produce precisely the extent of vibration that may be required in any particular case.

The longitudinal displacement of the muff can be effected in different ways. A simple lever, somewhat similar to a gear lever, may form part of the adjusting mechanism and be coupled to a fork whose limbs engage a pin that is coupled to the muff. Such an arrangement is appropriate when the vibration device is in the form of an independent entity that can be secured to any item that may require to be vibrated. Alternatively, the muff may be displaceable by an axially movable adjusting mechanism and such a construction is particularly appropriate for use where the vibration device is combined with a rotatable item such as a smooth roller apparatus.

When the vibration device is provided in the form of an independent entity, it is convenient to furnish a housing thereof with a foot adapted to be secured to, for example, a plate on any item that may require to be vibrated by the device, the housing accommodating the two co-axial shafts one of which preferably concentrically surrounds the other. If the vibration device is to be incorporated into, for example, a motorised ground roller, its housing can be designed in such a way as to co-operate with an internal partition of the actual ground-engaging roller drum or cylinder.

For a better understanding of the invention, and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:—

Figure 1 is a somewhat diagrammatic longitudinal section of a vibration device in accordance with the invention that is intended for use as an independent entity capable of being connected to any item that may require to be vibrated, and

Figure 2 is also a somewhat diagrammatic longitudinal section illustrating a second form of vibration device in accordance with the invention mounted internally of the rotary drum or cylinder of a smooth roller apparatus.

Referring to Fig. 1 of the drawings, the vibration device 1 thst is illustrated therein comprises a first shaft 2 having an end 3 which projects axially from the remainder of the device to carry a coupling plate 4 that is arranged to be driven, in a manner that is not illustrated, by an electric motor, internal com-

bustion engine or other prime mover. The coupling plate 4 could be provided with a toothed pinion, sprocket wheel, pulley or other transmission member. The shaft 2 is rotatably supported in a first half 8 of a housing 7 by axially spaced apart ball and roller bearings 5 and 6. Screw-threaded bolts 10 releaseably secure the first half 8 of the housing 7 to a second half 9 thereof, the shaft 2 carrying an eccentric weight 12 at a location just inside the first half 8 of the housing 7 and said weight 12 being mounted on the shaft 2 so as to be turnable about the axis of that shaft 2 against a significant degree of resistance to such turnability.

The first shaft 2 comprises a portion 2a that projects axially into the second half 9 of the housing 7, this portion 2a of the shaft 2 being coaxially surrounded by a second hollow shaft 13, the latter being rotatably supported by its surrounding relationship with the first shaft portion 2a and also by axially spaced apart roller and ball bearings 14 and 18 whose external races are lodged in the second housing half 9. The end of the second hollow shaft 13 that is closest to the junction plane between the two housing halves 8 and 9 carries an eccentric weight 15 which, like the eccentric weight 12 in relation to the first shaft 2, can be turned angularly about the second shaft 13 but only against significant resistance to such angular displacement. The end of the shaft portion 2a which is remote from the end 3 of the shaft 2 is rotatably supported by a ball bearing 16 mounted in an end cover 17 of the housing half 9.

A muff 19 of sleeve-like configuration is connected by co-operating screwthreads to a muff block 20, the latter being formed with an internally splined axial opening that co-operates with external splines 21 formed on the first shaft portion 2a towards the end of the latter that is rotatably supported by the ball bearing 16. Thus, the muff 19 and muff block 20 are axially displaceable relative to the shafts 2,2a and 13 but are not turnable about the common longitudinal axis of those shafts. However, the exterior of the second hollow shaft 13 is formed with steeply pitched thread means 22 and the interior of the surrounding sleeve-like muff 19 co-operates with the thread means 22 and thus, upon axial displacement of the muff 19 and muff block 20 to the left as seen in Fig. 1 of the drawings, the hollow shaft 13 will be caused angularly to change its position relative to the first shaft 2 about their common longitudinal axis with a corresponding angular displacement of the eccentric weight 15 relative to the eccentric weight 12.

The inner race of a ball bearing 24 is trapped between a shoulder of the sleeve-like muff 19 and the end of the screw-threaded portion of the muff block 20, a bearing shell 25 surrounding the outer race of the same ball bearing 24. The bearing shell 25 does not revolve and is provided with a substantially radially projecting pin 26 which is engaged by the limbs of a fork 29 formed at the end of a lever 28 which lever 28 is clamped to a shaft 27 turnably mounted in the walls of the housing half 9. A portion of the shaft 27 that projects from the exterior of the housing half 9 can be turned manually by a lever, similar to a gear lever, or can be moved by, for example, a servomotor that may be arranged to function automatically to increase or decrease the extent of the vibration in response to a sensing mechanism that controls the servomotor depending upon whether too little or too much vibration is detected. The top (in the position of the device shown in Fig. 1) of the housing half 9 is provided with a removable cover 29A closing an opening through which, when required, access can be had to the interior of the housing half 9.

The splines 21 ensure that, normally, the first and second shafts 2 and 13 will revolve at the same speed. Upon angular displacement of the lever 28 about the axis of the shaft 27, the muff 19 and muff block 20 will be moved axially along the portion 2a of the fist shaft 2 and the co-operation between the frictional muff 19 and the steeply pitched thread means 22 will cause the second hollow shaft 13 to be turned angularly around the portion 2a of the first shaft 2 thus changing the relative positions of the two eccentric weights 12 and 15. This action can take place whilst the device is in use and the construction is such that the two weights 12 and 15 can, as illustrated, occupy the same angular position about the common longitudinal axis of the shafts 2 and 13, a position in which the weight 15 is turned through 180° about said axis as compared with the illustrated position or any chosen intermediate position between these two extremes. The position of the weight 15 relative to that of the weight 12 is thus infinitely variable between a displacement of 0° and 180° around the common longitudinal axis of the two shafts 2 and 13.

The threads of the steeply pitched thread means 22 advantageously have a pitch angle of between 40° and 50°, inclusive. The extent of the vibration produced by the device is readily controllable between a maximum value when the two weights 12 and 15 occupy the same angular position about the common longitudinal axis of the shafts 2 and 13 and a minimum value (substantially no vibration) when the two weights 12 and 15 are 180° removed from one another around said longitudinal axis. As previously mentioned, the adjusting mechanism can readily be controlled in an automatic manner which will increase or decrease the extent of the vibration produced by the device in dependence upon, for example, the consistency of earth being com-

pacted principally by the vibration of the device.

The housing 7 of Fig. 1 of the drawings includes a foot 31 exhibiting fastening flanges 32 thus enabling the vibration device 1 quickly and easily to be attached in a horizontal or other position to any item that may require to be vibrated suchas a plate vibrator having mounting parts arranged to co-operate with the flanges 32.

Fig. 2 illustrates an alternative vibration device 34 in accordance with the invention but, in Fig. 2, many parts that are similar or identical to parts which have already been described in connection with Fig. 1 are indicated by the same references as are employed in Fig. 1 and will not be described again in detail. The device 34 is intended to be installed internally of the roller drum or cylinder 35 of, for example, a motorised roller or other smooth roller apparatus. An annulus 36 has its external edge welded or otherwise rigidly secured to the internal curved surface of the roller drum or cylinder 35 in such a way that the general plane of said annulus 36 is perpendicular to the longitudinal axis of the drum or cylinder 35. The vibration device 34 has a housing 7a whose housing half 9 is again releaseably secured to the co-operating housing half 8 by bolts 10 but, alongside those bolts 10 a flange of the housing half 9 is extened outwardly to allow it to be secured to the annulus 36 by further bolts 37.

In this embodiment, the end cover 17 of the housing half 9 is replaced by a larger end cover 17a of significantly greater axial thickness defining, through that axial thickness, slideways through which the shanks of corresponding bolts/studs 38 are axially displaceable. The inner ends of the bolts/studs 38 are anchored to a bearing shell 25a and the outer ends thereof are secured to the periphery of a plate 39 whose centre is fastened to an axially displaceable adjusting rod 40 whose longitudinal axis is coincident with the common longitudinal axis of the shafts 2 and 13 and the longitudinal axis of the roller drum or cylinder 35.

Once again, Fig. 2 shows the device in a position in which, when driven, it will produce maximum vibration, the two eccentric weights 12 and 15 being located at the same angular position around the common longitudinal axis of the shafts 2 and 13. Upon displacing the control rod 40, together with the plate 39 and the bolts/studs 38, in the direction indicated by an arrow in Fig. 2, the muff 19 and muff block 20 will again moe lengthwise along the portion 2a of the shaft 2, without revolving relative thereto because of the provision of the splines, but the steeply pitched thread means 22 will co-operate frictionally with the surrounding sleeve-like muff 19 so that the outer hollow shaft 13 will be turned angularly around the inner shaft portion 2a to change the angular setting of the eccentric weight 15 relative to that of the eccentric weight 12, the extent of the displacement being infinitely variable between the illustrated 0° (maximum vibration) position and a 180° (minimum/nil vibration) position, the actual position adopted being dependent upon the extent of the axial displacement of the control rod 40. In, for example, a motorised roller including the vibration device 34 that is somewhat diagrammatically illustrated in Fig. 2, the electric motor, internal combustion engine or other prime mover will be located at or near one axial end of the drum or cylinder 35 to transmit its drive to the coupling plate 4 and the adjusting mechanism which moves the rod 40 axially to-and-fro will be located adjacent the opposite axial end of the drum or cylinder 35.

CLAIMS

1. A vibration device of the kind set forth, wherein one eccentric weight is supported on a power-drivable first shaft and the other eccentric weight on a second relatively coaxial shaft, the first and second shafts being connected by means which resists their relative angular displacement and the first shaft also being angularly displaceably coupled to the second shaft by steeply pitched thread means.

2. A vibration device as claimed in claim 1, wherein the second shaft is of hollow formation and is mounted on the first shaft, and wherein the means which resists relative angular displacement of the first and second shafts is in the form of a frictional muff or the like.

3. A vibration device as claimed in claim 2, wherein the muff is mounted so as to be axially displaceable lengthwise of the first and second shafts and frictionally engages steeply pitched threads of said thread means that are carried bythe hollow second shaft.

4. A vibration device as claimed in claim 2 or 3, wherein the frictional muff is axially displaceable lengthwise of the first and second shafts by an adjusting mechanism which comprises a non-rotatable support shell, a projection carried by that support shell, a forked lever displaceably engaging the projection and means located externally of the device to turn said lever about an axis.

5. A vibration device as claimed in claim 2 or 3, wherein the frictional muff is displaceable lengthwise of the first and second shafts by an adjusting mechanism that is movable substantially only axially.

6. A vibration device as claimed in any preceding claim, wherein a housing of that device in which said first and second shafts are coaxially supported comprises a foot constructed and arranged for connection to a vibration plate or other item which is required to be vibrated by the device.

7. A vibration device as claimed in any

one of claims 1 to 5, wherein a housing of the device in which said first and second shafts are coaxially mounted is secured to an internal projection of a drum or cylinder of a roller.

8. A vibration device substantially as hereinbefore described with reference to either Fig. 1 or Fig. 2 of the accompanying drawings.

9. A smooth roller apparatus when provided with a vibration device according to any one of claims 1, 2, 3, 5, 7 or 8.

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